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MALLEABLE IRON CASTING

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This invention relates to the manufacture of malleable metal castings with abrasive non-skid surfaces. More particularly, it relates to malleable metal castings having abrasive particles embedded therein.

It is known in the art that metal surfaces forming the treads of steps and the like become smooth with wear and the smooth surface becomes a menace to the safety of those stepping thereon. Many attempts have been made to overcome this difficulty. Cast iron steps having abrasive grains embedded therein have been found to prevent the formation of a smooth surface by wear and such treads have been the subject of numerous patents and have been used in industry. While cast iron steps with abrasive particles embedded therein have a non-skid surface, they have many disadvantages which make them undesirable. Thus, they warp with age, and they crack and break when subjected to sudden temperature changes or as the result of an impact or shock. Accordingly, when used where they are subject to sudden temperature changes or impacts or shocks, the loss due to breakage is high. Moreover, this loss may be accompanied by injury to the user and, hence, cast iron steps may become a safety hazard. Attempts have been made to overcome these difficulties by the use of wrought iron treads. However, it is difficult to incorporate into wrought iron abrasive grains so as to firmly embed them therein. Accordingly, such treads have not come into general use. Because of the shape of steps, the making of complete steps of wrought iron does not appear to be practicable.

It is an object of this invention to make a non-skid metal member having good wear resistance and capable of resisting warping and breaking. Another object is to make a tough non-skid, shock resistant, metal member having abrasive particles firmly embedded therein. A further object is to make a non-skid iron member with abrasive particles firmly embedded therein, which member has improved corrosion resistance.

These objects have been accomplished by the discovery that it is possible to make a malleable cast ferrous metal member with abrasive particles firmly embedded therein. Preferably, the malleable cast iron contains copper alloyed therewith to increase rust resistance as is more fully explained hereinafter.

In order that the invention may be more fully understood, the following specific example is set forth, but it is to be understood that the exam-

ple is merely by way of illustration and that the invention is not limited thereto.

Example I

A mold of a step was made of green sand, the sand of the drag being somewhat drier than usual practice. The drag was sprayed with water and powdered with pulverized bonding clay. Particles of "aloxite" (fused aluminum oxide) of a size between 16 and 20 mesh were then distributed upon the drag whereby they became slightly embedded in the bonding clay, which, in turn, dried and held the particles fixed in place preventing displacement when the metal was poured into the mold. The particles were most plentifully supplied at the part of the drag which corresponded to the nosing (outer junction of riser and tread) of the finished step. The cope was then placed on the drag and the mold was filled with molten metal through a suitable gate and riser. The metal used was a rust-resistant iron containing 2.25 per cent carbon, the usual amounts of manganese, silicon and other elements usually found in malleable cast iron and 0.20 per cent of copper. This rust-resistant material is described and claimed per se in U. S. Patent No. 1,535,549, and the disclosure of said patent is herein incorporated by reference. In this way, a casting was made with abrasive particles firmly embedded and held therein.

When the casting was cold, it was cleaned, put in an annealing pot, packed with sand, loaded on a car, and annealed in a muffle furnace having regulated temperature control. After annealing the casting, which was originally hard and very brittle, was tough and malleable. It was capable of withstanding sudden temperature changes.

The step made according to the invention was subjected to the pressure of several tons and finally bent, but did not break. The same step was then subjected to repeated vigorous and forceful blows with a heavy sledge. The impacts of these blows were withstood without breaking. By way of contrast, a cast iron step was tested. This step, although heavier than the one made according to the invention, was broken into pieces by the first impact of a sledge of the same weight, which, in this instance, was not wielded with force, but was merely held above the casting and allowed to fall of its own weight.

In general, the annealing is carried out with a maximum temperature of between 1550° F. and 1650° F., but the invention is not limited thereto. It is desirable to so control the annealing that

the temperature variation between various parts of the casting is minimized to avoid uneven growth of the casting.

One important feature in the molding is that the pattern and mold are so made that the nose of the step is not in line with the junction of the drag and the cope. Hence, there is no rough edge formed at this point needing to be ground off. Grinding removes the abrasive particles, and, hence, is not desirable.

Although the invention has been specifically described with regard to a step, it is not limited thereto. Flat plates, angle plates, nosings, and other shaped articles are within the scope of the invention. The abrasive particles are firmly embedded in that part of the article which will be subjected to wear. For many purposes, the abrasive particles will be embedded firmly in the upper surface of the malleable ferrous metal casting. Where flat plates or other reversible shapes are made, the abrasive particles may be embedded in both sides of the casting, as, for example, by adhering the particles to both the drag and cope of the mold. In instances where extreme wear is anticipated, the abrasive particles may extend throughout the casting. This may be accomplished, for example, by adhering the particles to the drag with varying degrees of firmness so that some of them become loosened and float up into the molten metal.

The abrasive particles which will work in this invention are those commonly used in the abrading and grinding arts. Preferably, abrasive particles having a high fusion temperature (above 1550° F. to 1650° F.) are used since the annealing process tends to loosen and destroy particles of low fusion temperatures. The preferred materials are corundum (a hard natural form of aluminum oxide), fused aluminum oxide (sold under trade names of "aloxite," "alundum," etc.), and fused silicon carbide (carborundum).

The abrasive particles are of suitable size for the particular type of casting. In general, sizes from 4 to 100 mesh are considered satisfactory. Preferably, sizes from about 8 to 40 mesh are used, and sizes of from 16 to 20 mesh are especially preferred.

The adhering of the abrasive particle to the mold is preferably, but not necessarily, accomplished as above described. Alternatively, the abrasive particles may be placed on the mold by any suitable method, such, for example, as by the methods described in U. S. Patent Nos. 954,967; 1,403,005; 1,893,539; 1,920,244; and 1,978,319.

While the specific example disclosed a non-skid malleable metal casting of a copper-iron alloy, the invention is not limited thereto. Malleable cast iron and other malleable ferrous castings will work in the invention. Other metals such as chromium, nickel, manganese and molybdenum may be alloyed with the iron. Pearlitic malleable cast iron may be used. However, straight malleable cast iron is preferred. Where corrosion resistance is an important factor, the addition of a small amount of copper such as described in U. S. Patent No. 1,535,549 is especially preferred.

Products made as herein described may be successfully used as steps, treads for steps, nosings for steps or platforms, and plates for use on ramps and bridges and elsewhere. They are useful whenever it is desired to obtain an abrasive surface for walking, ascending, or descending, either on foot or when riding in vehicles mounted

on wheels. Railroad car steps, and steps in terminals and other public places made from this product assure the maximum safety coupled with long service.

It is apparent that many widely different embodiments of this invention may be made without departing from the spirit and scope thereof, and, therefore, it is not intended to be limited except as indicated in the appended claims.

I claim:

1. A malleable iron casting having abrasive particles embedded therein, said casting having been made by casting the metal around the abrasive particles and then annealing the casting.

2. A highly rust-resistant malleable iron alloy casting having abrasive particles embedded therein, said casting having been made by casting the metal around the abrasive particles and then annealing the casting.

3. A malleable iron casting having a surface comprising abrasive particles embedded therein, said casting having been made by casting the metal around the abrasive particles and then annealing the casting.

4. A highly rust-resistant malleable iron alloy casting having a surface comprising abrasive particles embedded therein, said casting having been made by casting the metal around the abrasive particles and then annealing the casting.

5. A malleable iron casting having particles of abrasive of a high temperature of fusion embedded in the surface thereof, said casting having been made by casting the metal around the abrasive particles and then annealing the casting.

6. A highly rust-resistant malleable iron alloy casting having particles of an abrasive of a high temperature of fusion embedded in the surface thereof, said casting having been made by casting the metal around the abrasive particles and then annealing the casting.

7. A malleable ferrous metal casting having particles of fused aluminum oxide embedded in the surface thereof, said casting having been made by casting the metal around the fused aluminum oxide particles and then annealing the casting.

8. A malleable ferrous metal casting having particles of corundum embedded in the surface thereof, said casting having been made by casting the metal around the corundum particles and then annealing the casting.

9. A malleable ferrous metal casting having particles of fused silicon carbide embedded in the surface thereof, said casting having been made by casting the metal around the silicon carbide particles and then annealing the casting.

10. A wear-resistant, non-skid tread surface element of malleable cast ferrous metal having abrasive particles firmly embedded therein, said casting having been made by casting the metal around the abrasive particles and then annealing the casting.

11. A wear-resistant, non-skid stair tread of malleable ferrous metal having abrasive particles firmly embedded therein, said casting having been made by casting the metal around the abrasive particles and then annealing the casting.

12. A wear-resistant, non-skid stair step of malleable cast iron having abrasive particles firmly embedded in the tread surface thereof, said casting having been made by casting the metal around the abrasive particles and then annealing the casting.

13. A wear-resistant, non-skid step of annealed malleable cast iron having abrasive particles of 16 to 20 mesh cast in the tread surface and the nose surface thereof further characterized in that the rough edge formed at the juncture of the drag and cope is at a point other than the nose of the step.

14. A wear-resistant, non-skid step of annealed malleable cast iron having abrasive particles of fused aluminum oxide of 16 to 20 mesh cast in the tread surface and the nose surface thereof further characterized in that the rough edge formed at the juncture of the drag and cope is at a point other than the nose of the step.

15. A wear-resistant, non-skid step of annealed malleable cast iron having abrasive particles of corundum of 16 to 20 mesh cast in the tread surface and the nose surface thereof further characterized in that the rough edge formed at the juncture of the drag and cope is at a point other than the nose of the step.

16. A wear-resistant, non-skid step of annealed malleable cast iron having abrasive particles of silicon carbide of 16 to 20 mesh cast in the tread surface and the nose surface thereof further characterized in that the rough edge formed at the juncture of the drag and cope is at a point other than the nose of the step.

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